

# NASA TECH BRIEF

## Ames Research Center



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### Laser Device Provides Accurate Reference to True Gravitational Vertical

A new device, based on a modification of a conventional laser, provides an accurate and convenient reference to the true gravitational vertical. An indication of correct alignment is given by the in-

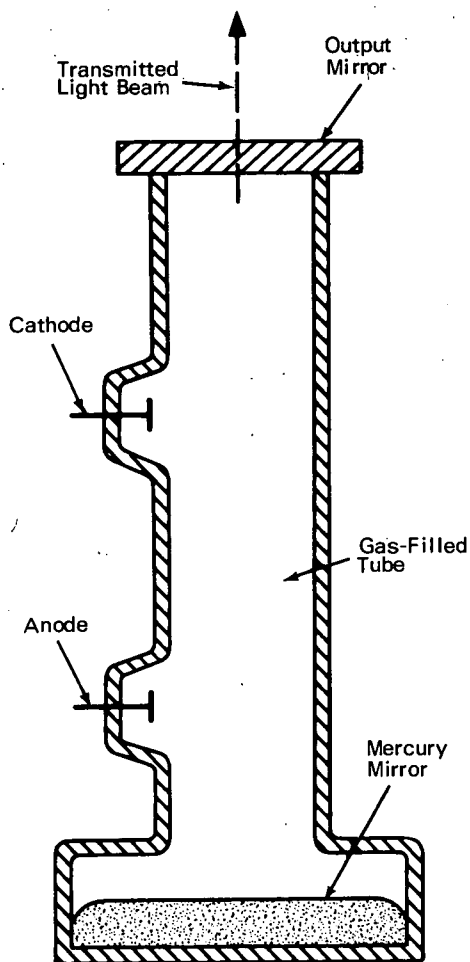
tensity of the output, which peaks sharply when the axis of the beam is vertical but rapidly falls off to zero outside of a small cone of error.

The key to the new design lies in the use of the surface of a pool of mercury as a gravity-sensitive cavity mirror. Referring to the diagram, laser action is stimulated only when the two mirrors are normal to the axis of the beam; thus, because one mirror (the mercury mirror) is always normal to the vertical, the other mirror must also be normal to the vertical, and therefore the output beam will be parallel to the true gravitational vertical.

As indicated in the diagram, the device is comprised of a gas-filled tube, a cathode, an anode, an output mirror which transmits part of the light and reflects the rest, and the mercury mirror. When the tube is moved to ensure maximum light transmission through the output mirror, the light beam will follow true vertical and can be used for reference. Note that the light beam is not necessarily parallel to the geometric axis of the gas-filled tube.

This device is inherently superior to a plumb bob whenever accuracy and steadiness are vital, and especially where long vertical alignments render the use of a plumb line impractical. It is also more accurate for this application than a conventional laser leveled by bubbles, and does not require expensive optical components.

The mercury mirror should be enclosed in a shock-mounted container in order to reduce beam unsteadiness. To eliminate contamination problems associated with the high vapor pressure of mercury, the enclosure should be separated from the gas tube.



(continued overleaf)

For better reflectivity, a mirror coated with a solid dielectric can be floated on the surface of the mercury, or of any other appropriate liquid.

**Note:**

Requests for further information may be directed to:

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Reference: TSP71-10479

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to:

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